Satellites, Oceanography and Society

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Introduction

Satellites and Oceanography

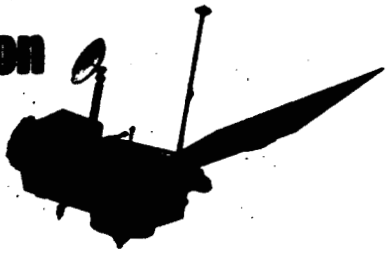
- navigation
- global warming
- El Niño / La Niña
- CO_2
- fisheries
- pollution
- marine weather
- exploration

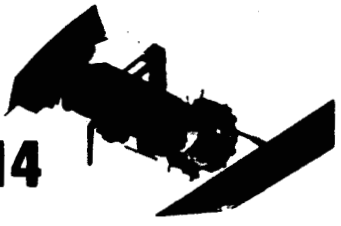
Oceans Agenda: Monitoring, Modeling, Forecasting

DMSP
SSM/I

SeaStar
SeaWIFS

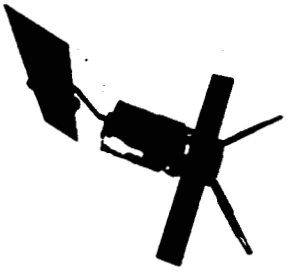
TOPEX/Poseidon





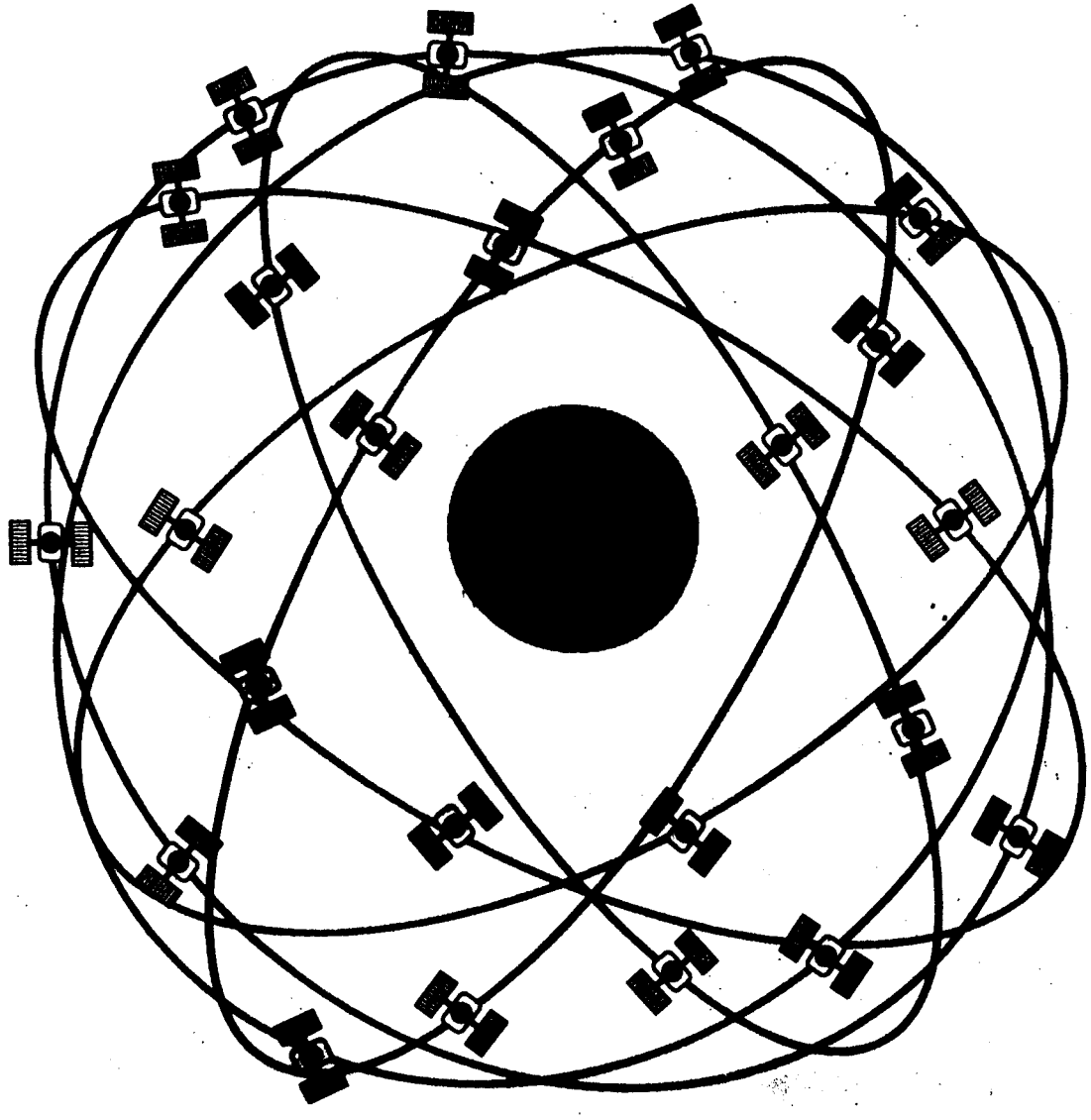
NOAA-7/8/9.../14
AVHRR

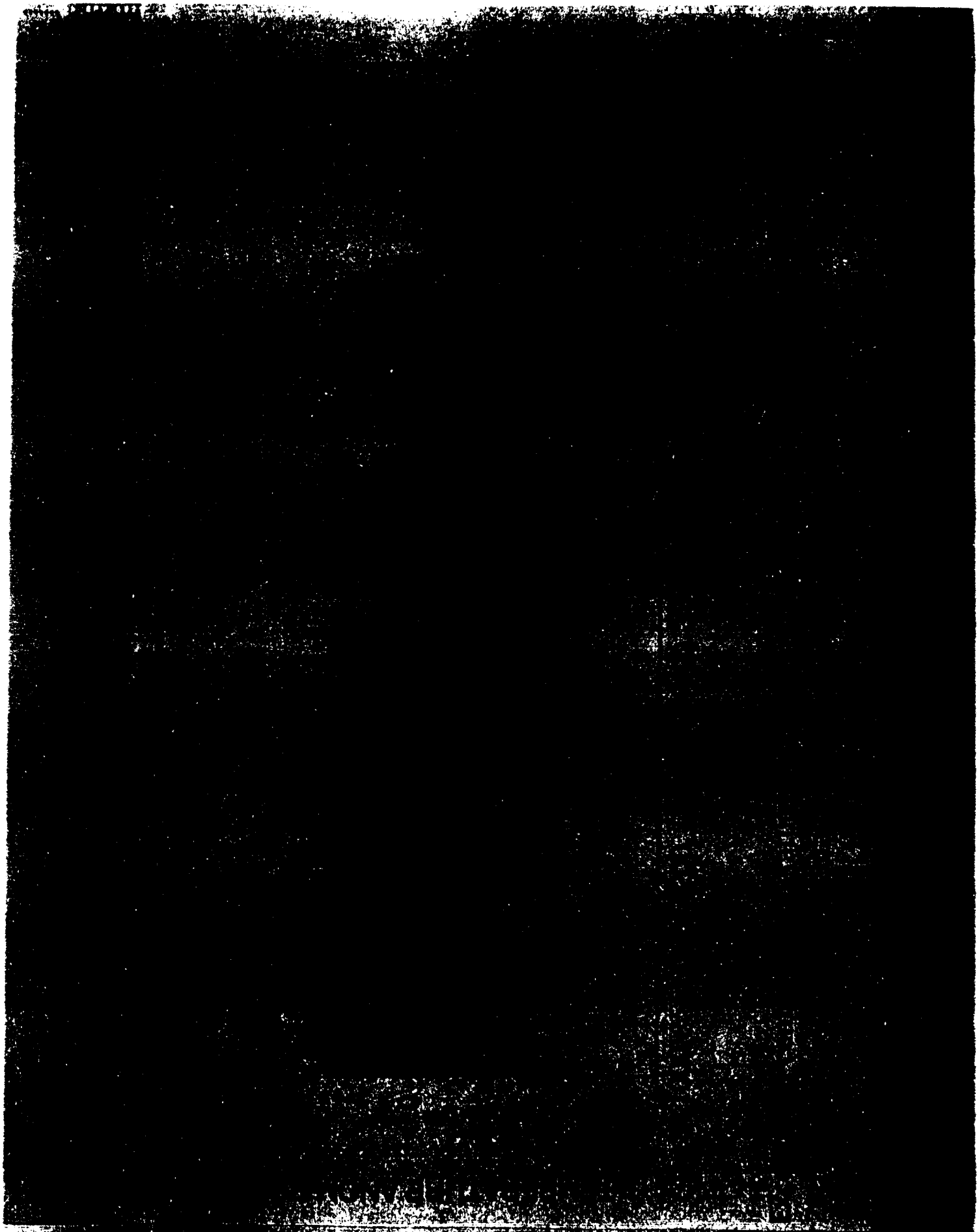
ADEOS
NSCAT
OCTS
POLDER

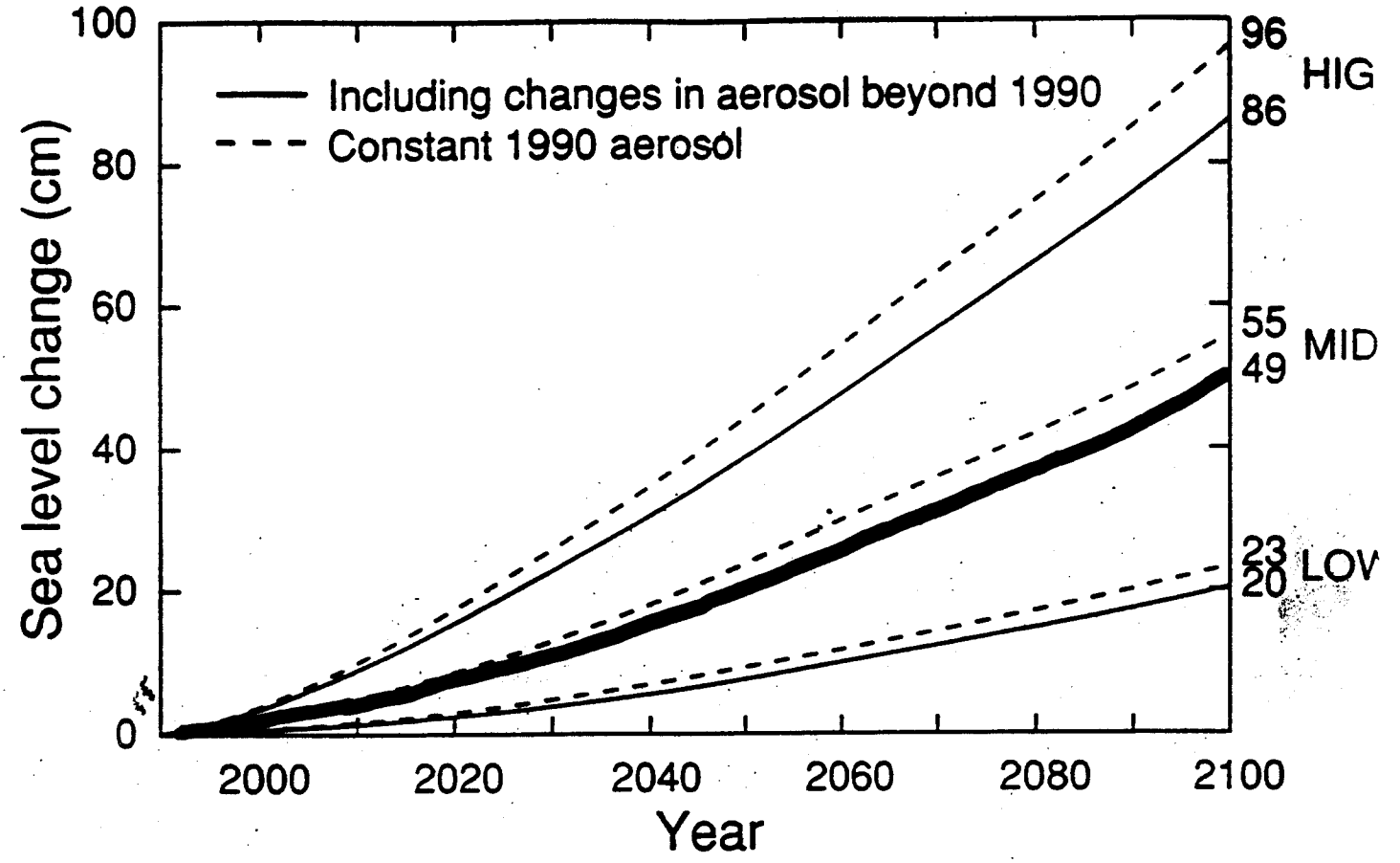


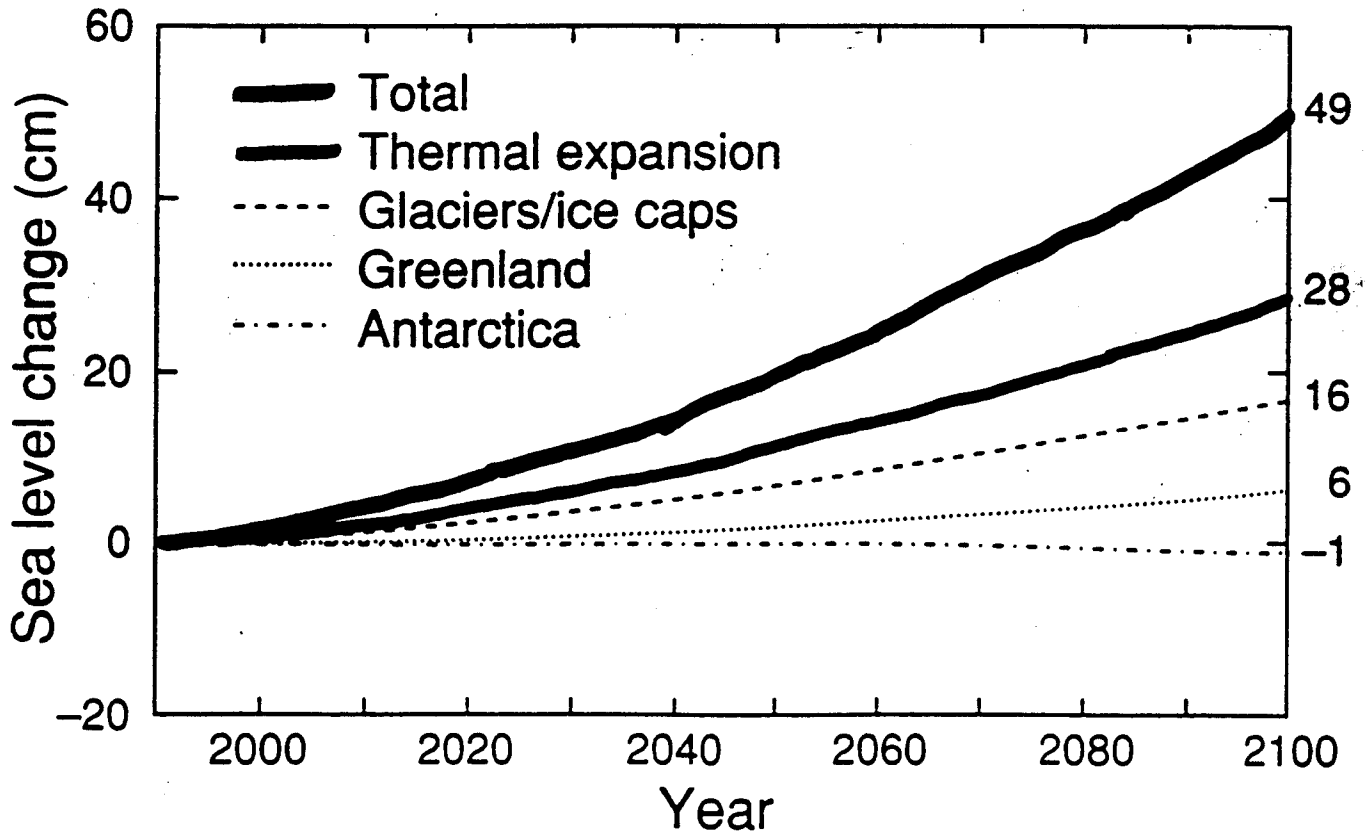
ERS-1/2
altimeter
scatterometer
SAR

THE GLOBAL POSITIONING SYSTEM

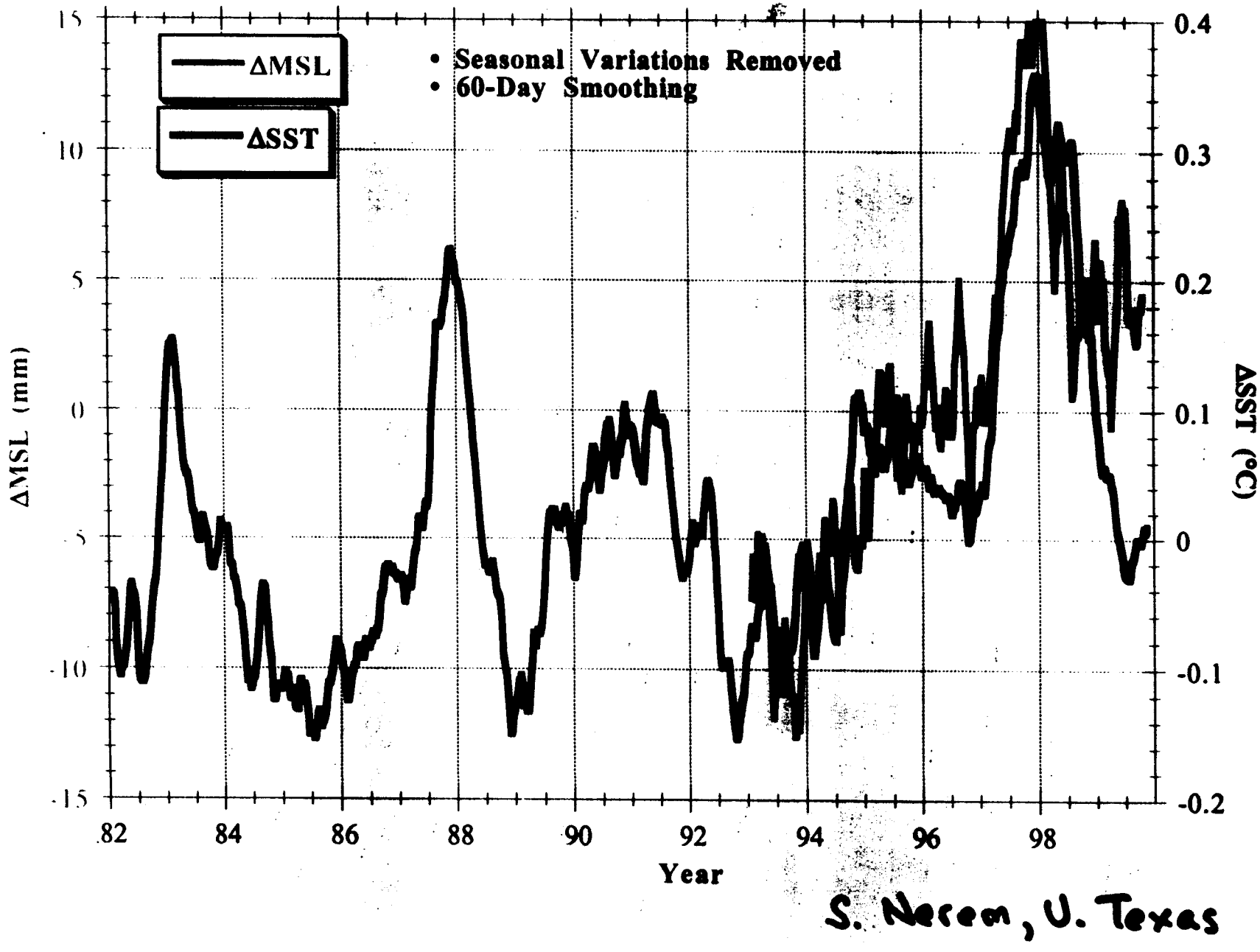








Warrick et al. (1996), In "IPCC 1995"


ΔMSL
ΔSST
• Seasonal Variations Removed
• 60-Day Smoothing
ΔMSL (mm)
ASST (°C)
Year
15
10
5
0
-5
-10
-15
0.4
0.3
0.2
0.1
0
-0.1
-0.2
82
84
86
88
90
92
94
96
98
S. Nerem, U. Texas

Impacts of 1997–98 El Niño–Generated Weather in the United States

Stanley A. Changnon
(1999)

TABLE 1. National tally of impacts from weather condition attributed to El Niño, 1997–98.

LOSSES

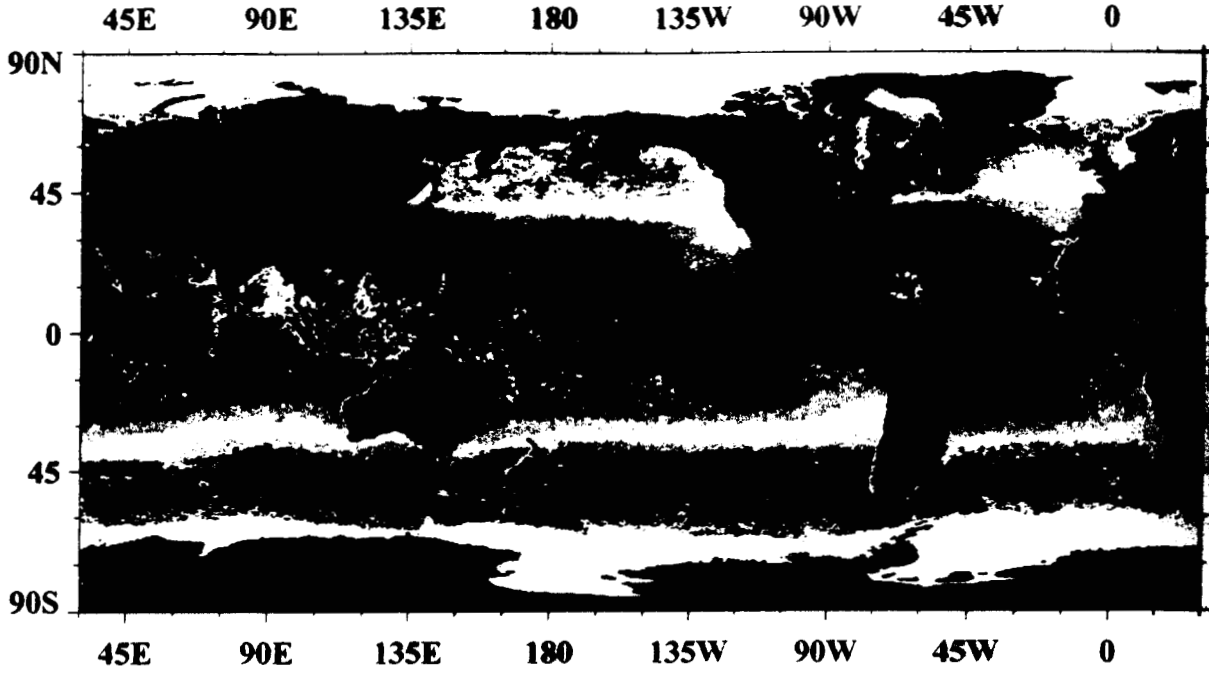
Human lives lost = 189
Economic losses and costs = $4.2–$4.5 billion

BENEFITS

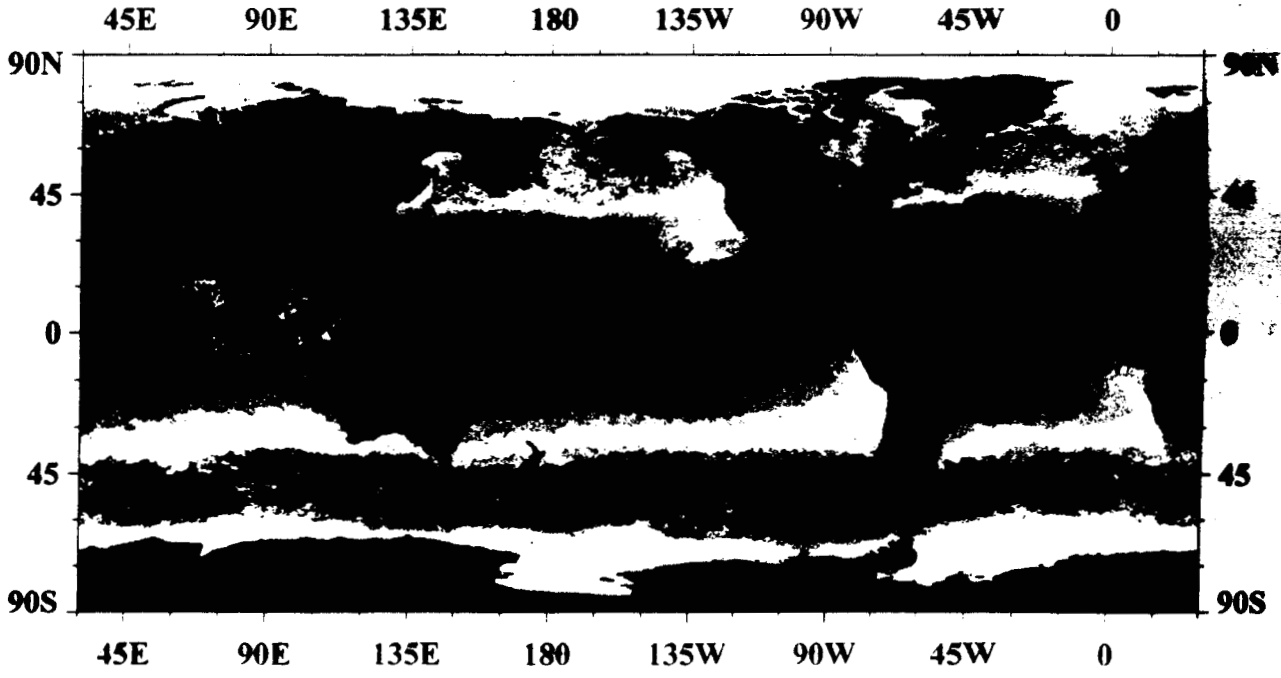
Human lives saved = 850
Economic gains = $19.6–$19.9 billion

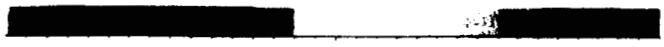
AVHRR Sea Surface Temperature, °C

(a) July 1997

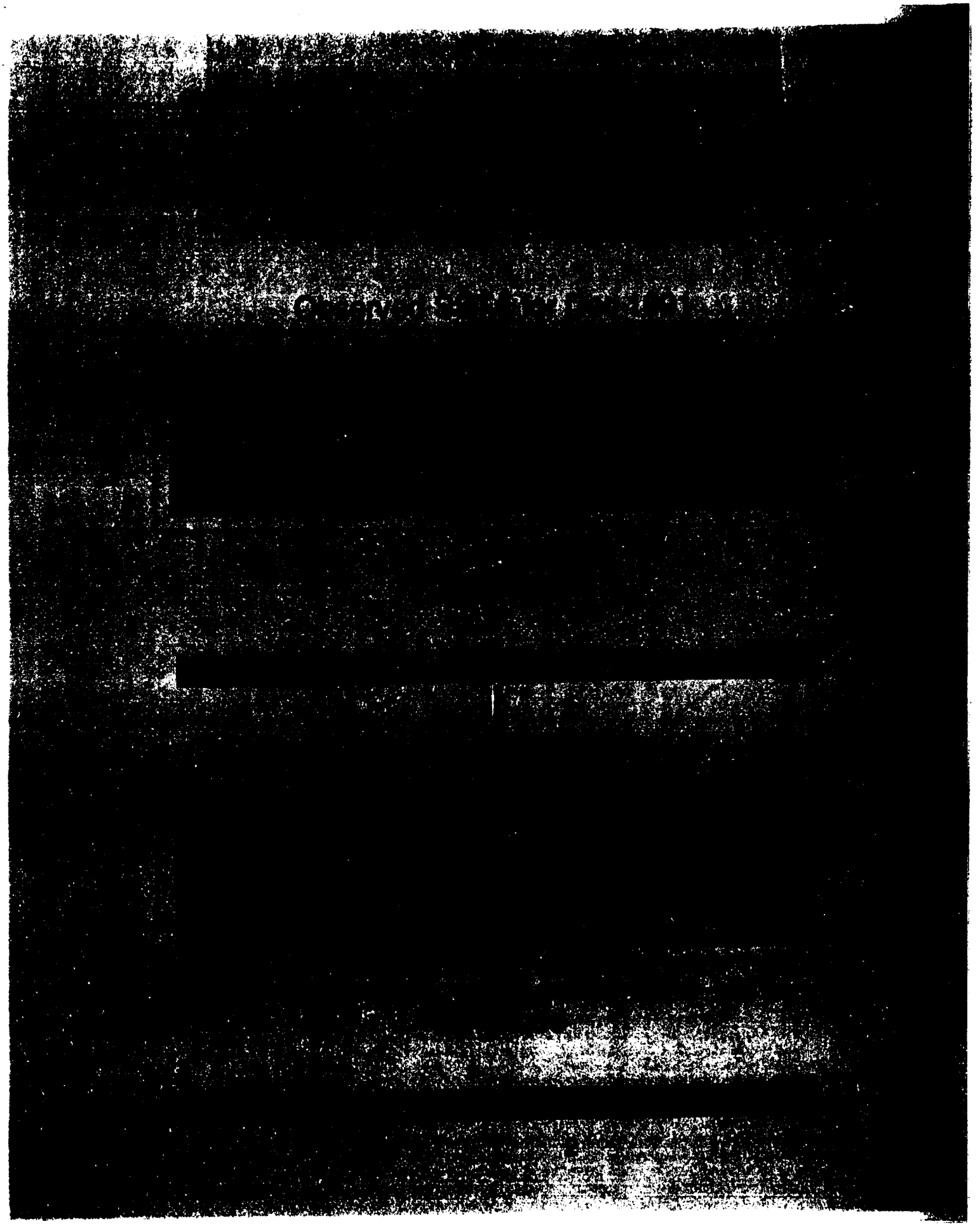


(b) July 1998



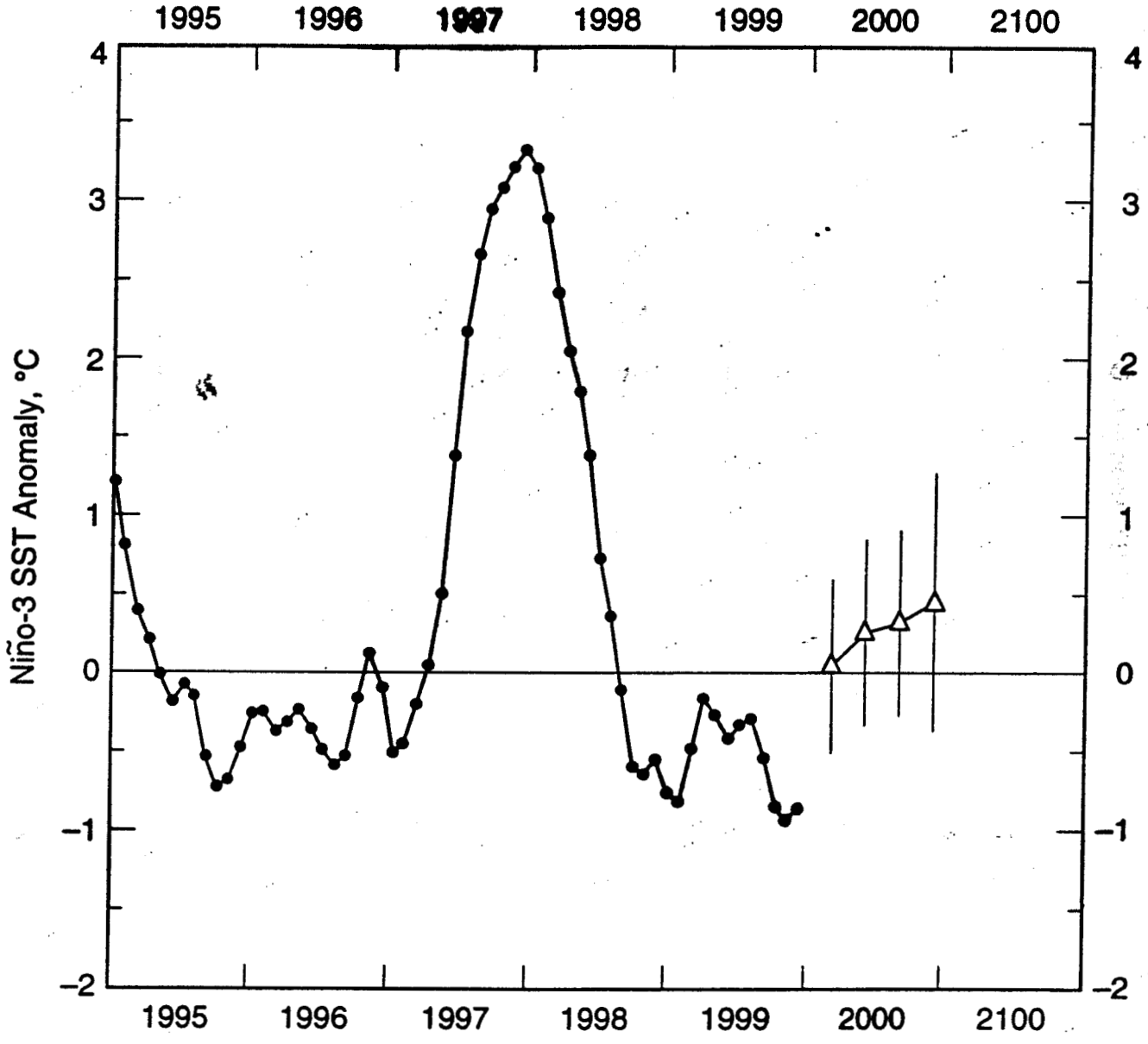


AVHRR Sea Surface Temperature, ^{0}C



1–4 Seasons Forecast

Saunders, Ghil, and Neelin (UCLA)



Operational Oceanography. The Challenge for European Co-operation
edited by J.H. Stel, H.W.A. Behrens, J.C. Borst, L.J. Droppert, J. v.d. Meulen

Cost Benefit Analysis of TOGA and the ENSO Observing System[1]

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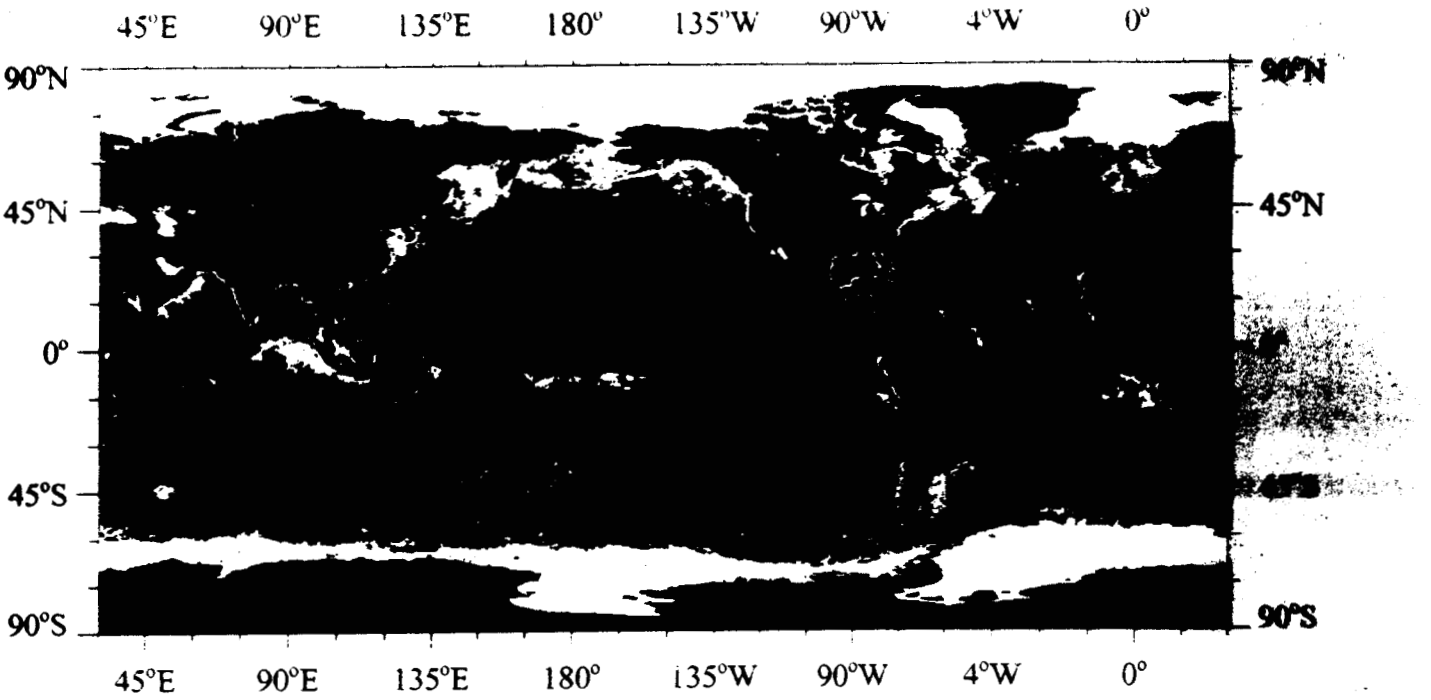
R&D programs intended to develop climate prediction capabilities are costly. But if they are successful, they yield continuing economic benefits. However, because such benefits are difficult for private companies to capture, it falls to the public sector to pursue them. Public sector decision makers, before funding climate research programs, must be convinced that such programs serve the public interest, i.e., that their economic benefits exceed their economic costs. The purpose of this paper is to shed some light on that issue. Specifically, we construct a cost benefit analysis of the recently completed TOGA (Tropical Ocean Global Atmosphere) program. TOGA, a successful 10 year international scientific effort to understand and model the ENSO (El Nino / Southern Oscillation) phenomenon, has led to models which are capable of predicting ENSO events a year or so in advance. In our cost benefit analysis, we used estimates of the benefits of climate forecasts to the U.S. agricultural sector, the actual historical and the estimated future costs (to the U.S.) of the research, development and operationalization that climate forecast system, and a 36 case sensitivity analysis. Our results indicate that TOGA will provide a real economic return on investment to the U.S. of at least 13% to 26%, depending on the assumptions made in the analysis. This is substantially in excess of the hurdle rate of 7% usually used by the federal government. We conclude that the TOGA program was a sound use of public resources, and that additional funding of climate forecasting R&D efforts (at both the national and international levels) merits serious consideration.

1. INTRODUCTION

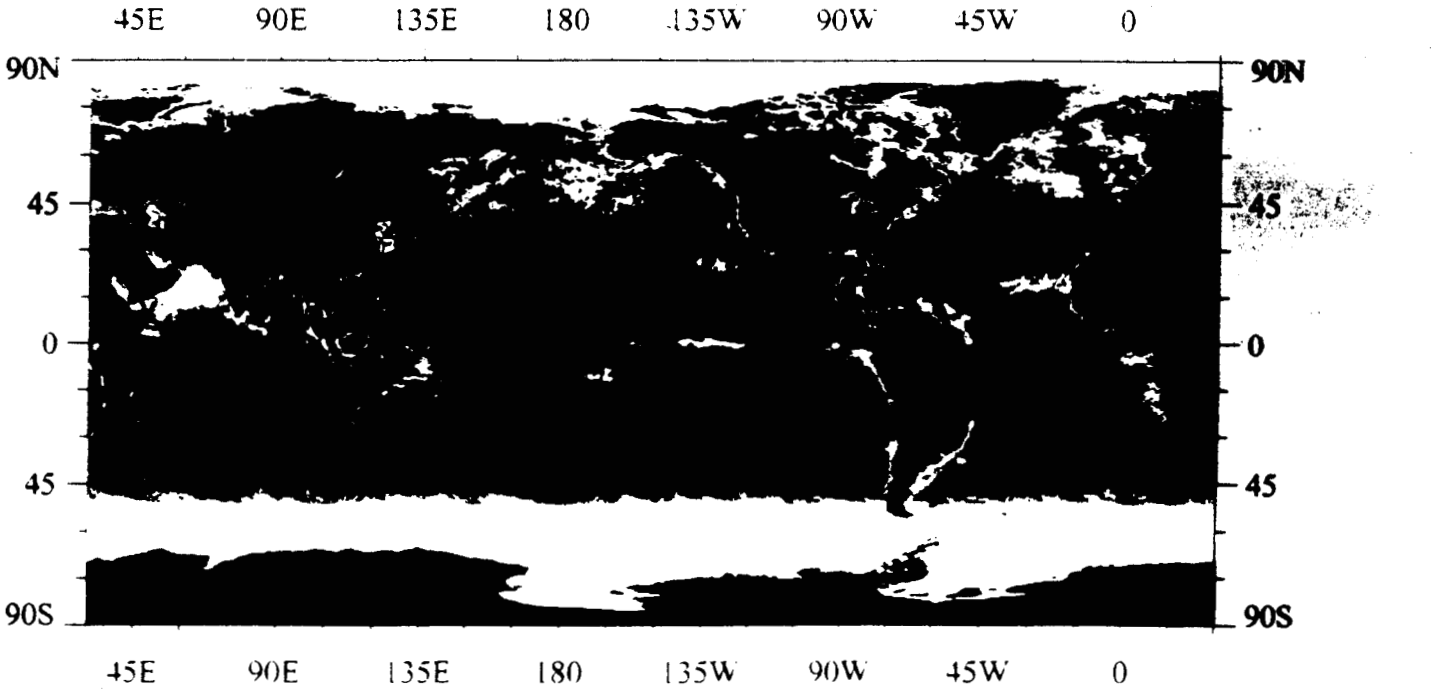
The successful prediction of climate, which may be viewed as long term average weather patterns, has economic value. Farmers who know in advance whether the coming growing season will be warmer or cooler than average, or wetter or drier, can adjust their planting strategy to take advantage of this information - perhaps by planting earlier or later, or using a

SeaWiFS Chlorophyll-a Concentration, mg m^{-3}

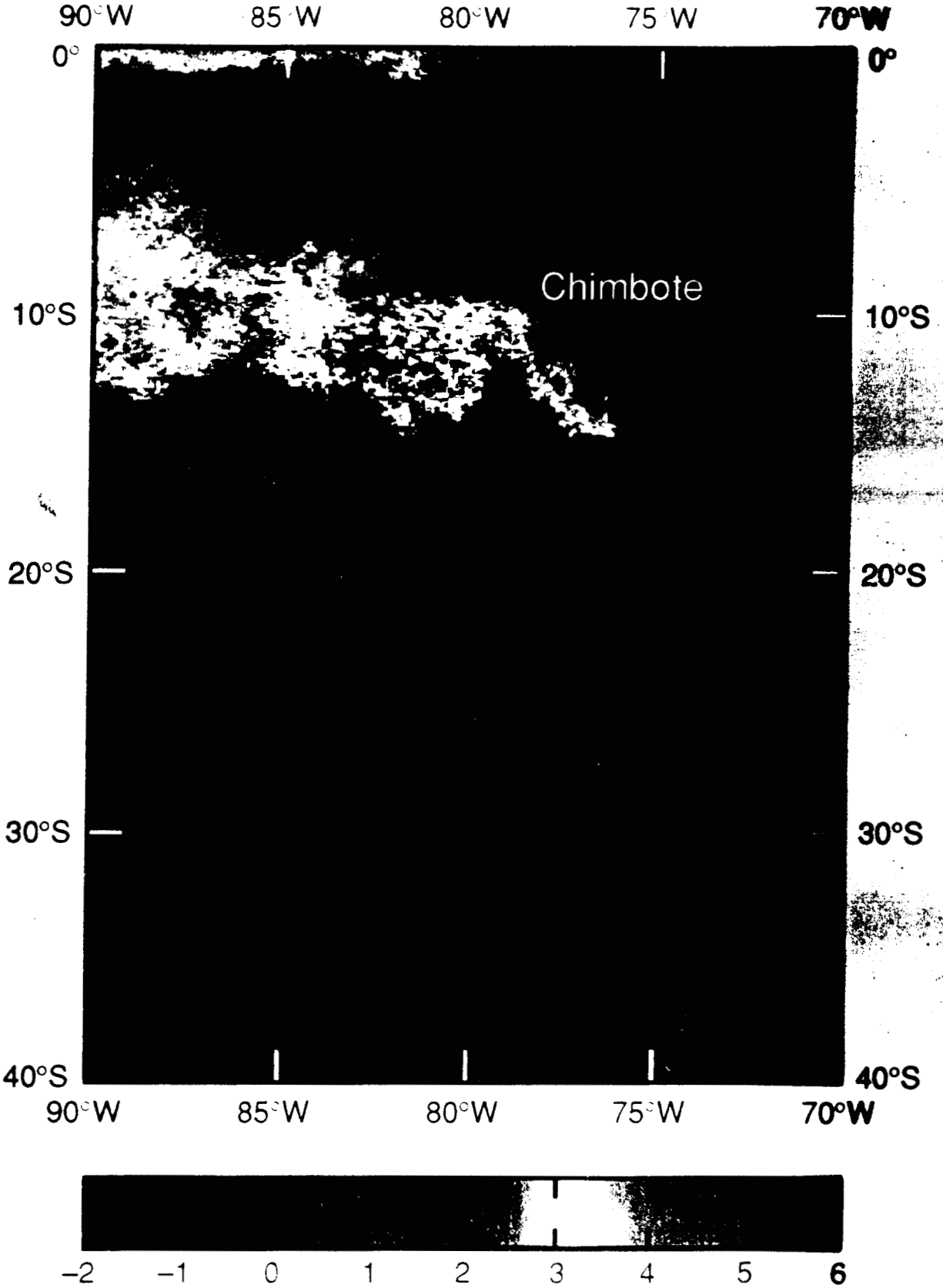
(a) October 1997



(b) July 1998



SeaWIFS Monthly Mean Chlorophyll-a Concentration, mg m^{-3}



December 1997 AVHRR/Pathfinder SST Anomaly, °C

Carr and Broad (2000)

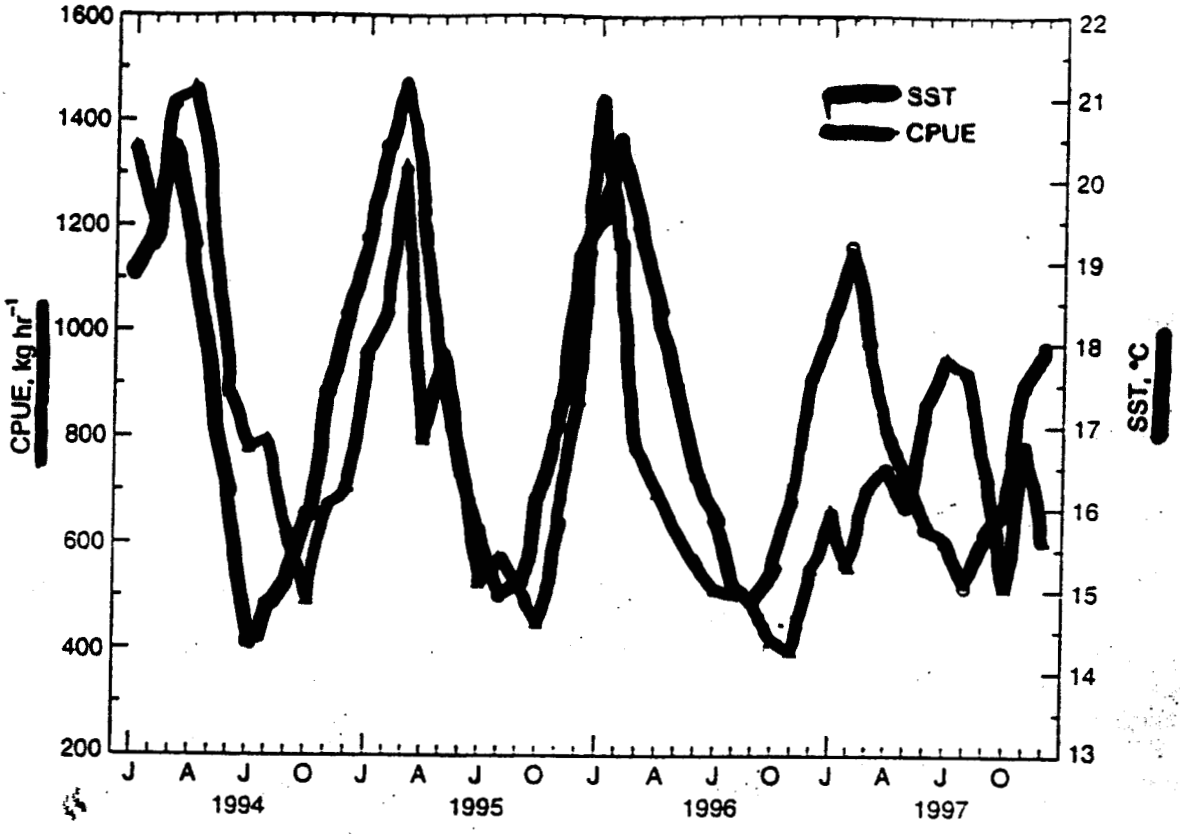


Figure 1. Monthly time series of SST, averaged from 18° to 30°S at the 200-m isobath, and Namibian hake CPUE.

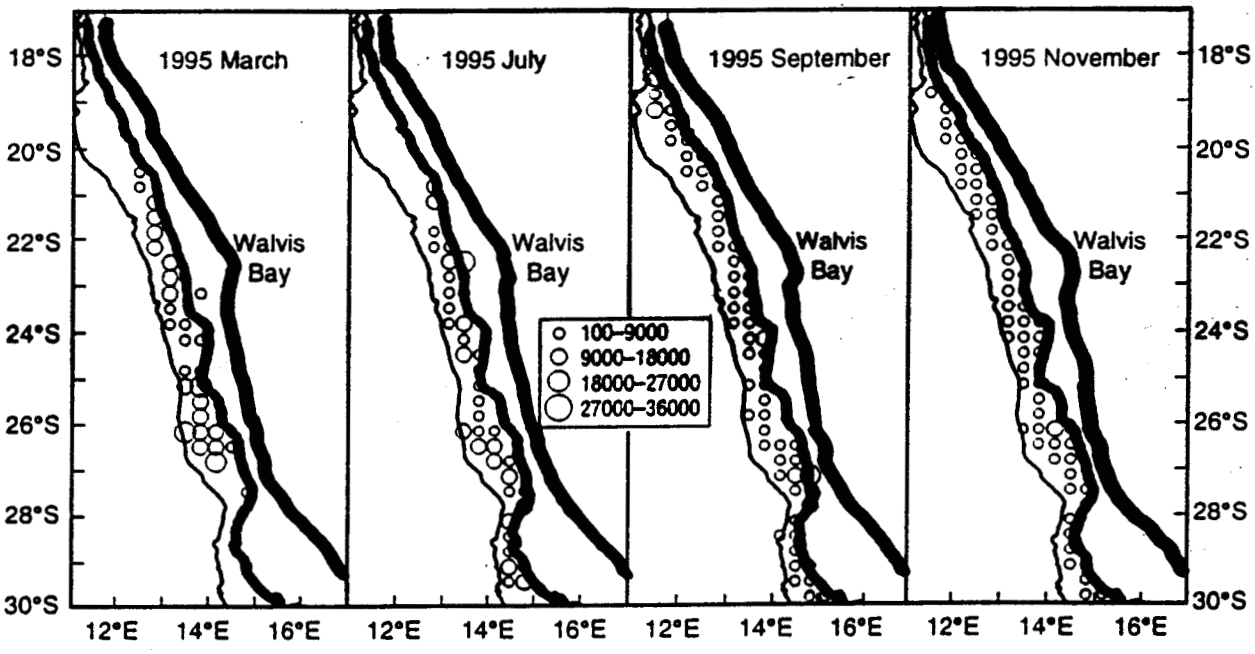
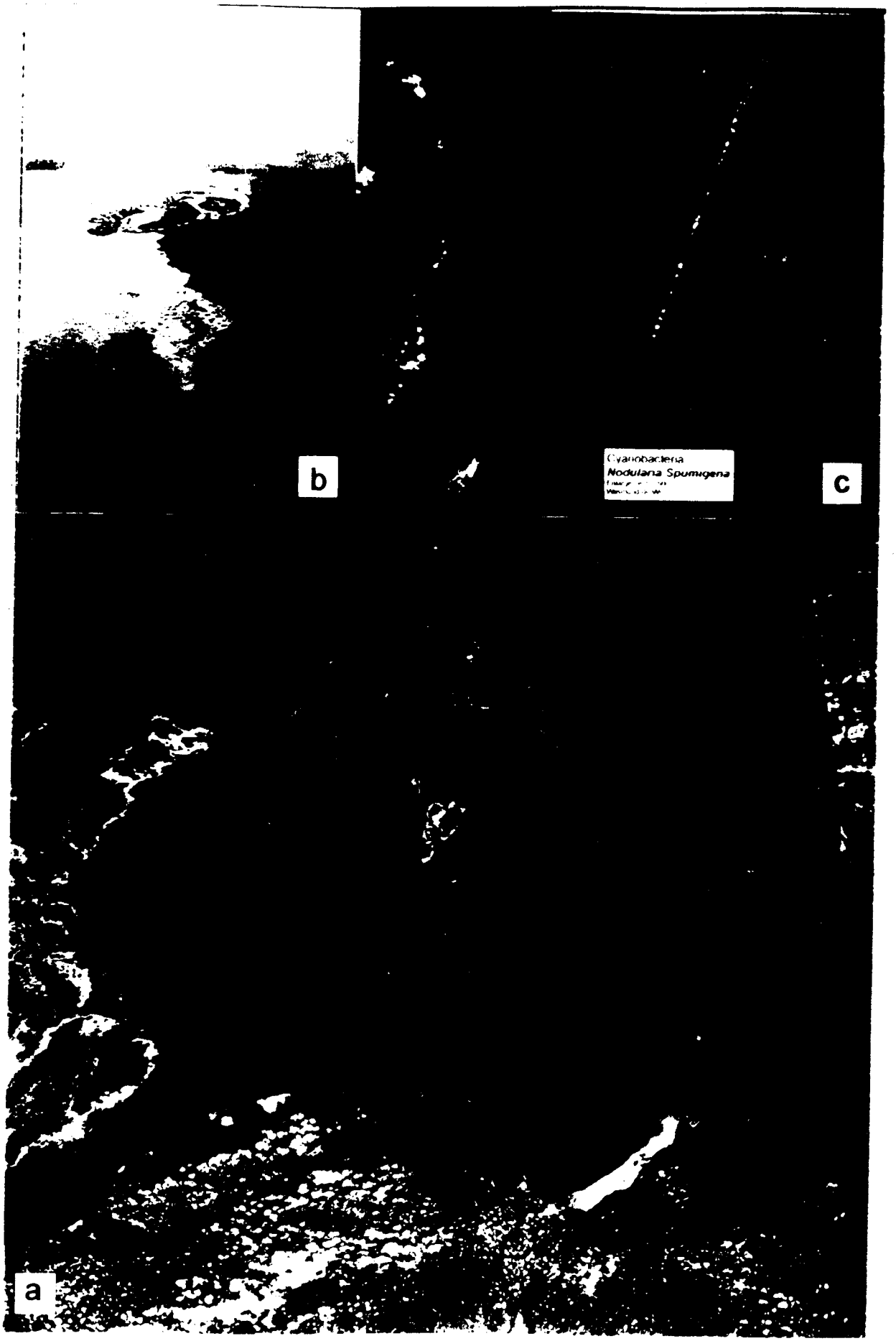


Figure 2. Monthly CPUE (kg day^{-1}) for summer (March), autumn (July), winter (September), and spring (November). Each CPUE is representative of a 32-km × 32-km region. The thick lines are the 200- and 500-m isobaths. Areas without data are areas of no fishing activity, but are not areas of no fish.

Gordoa et al. (2000)


b
Cyanobacteria
Nodulana Spumigena
c
a

LOS ANGELES TIMES
[redacted]DAY, MAY [redacted], 200[redacted]

Beach Closed by Sewage Spill

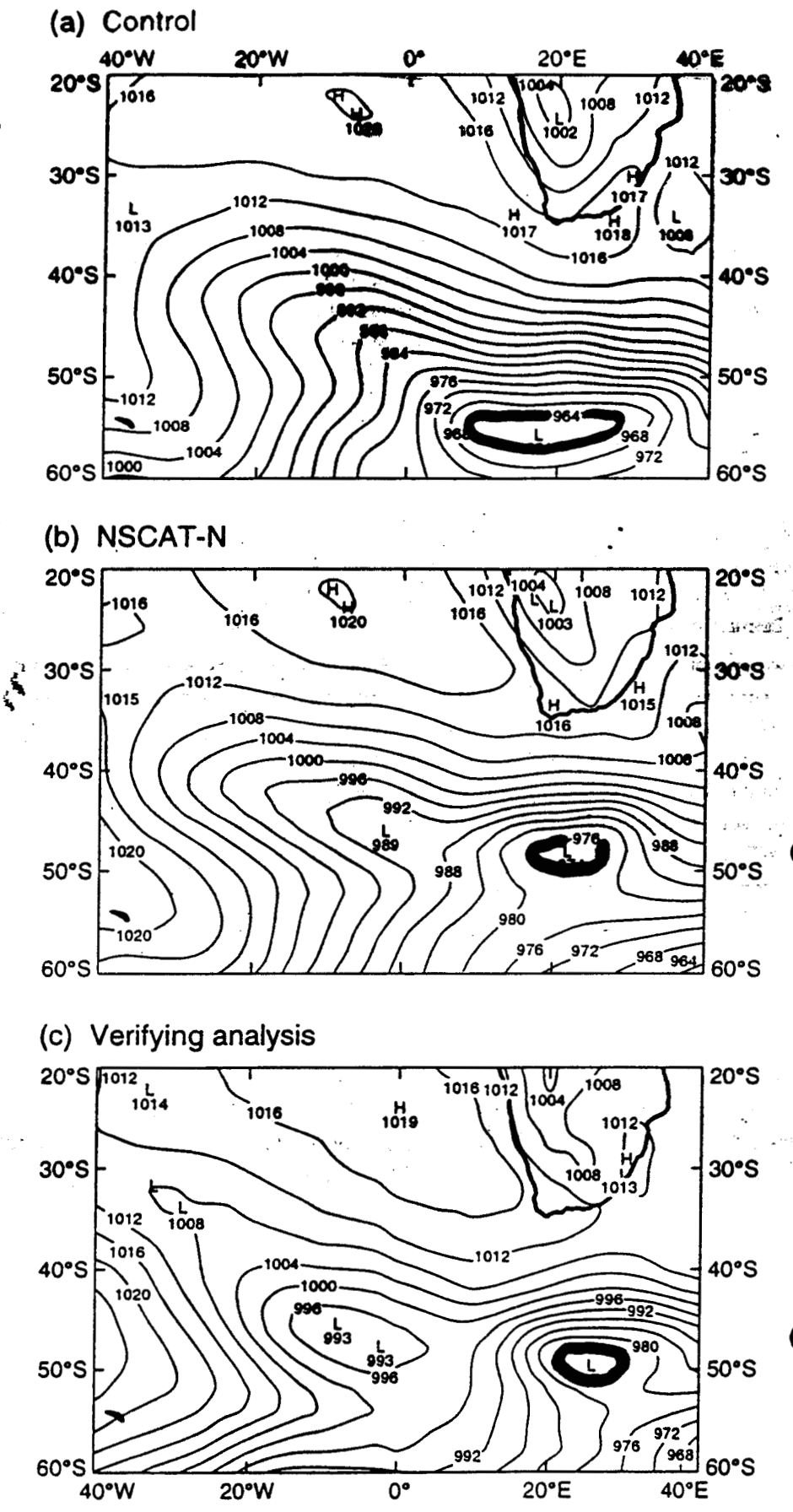
County health officials closed a two-mile stretch of beach in Redondo Beach and Torrance on Saturday morning because of sewage contamination.

Firefighters responding to a sewage overflow about 9:40 a.m. found sewage flowing out of a manhole and into a storm drain. About 2,500 to 3,000 gallons of sewage flowed to the storm pipes and the ocean at two locations in Redondo Beach—Avenue F and Vista Del Mar, officials said.

Officials closed the beach about 11 a.m. from Knob Hill Avenue in the north to the Torrance-Palos Verdes Estates border in the south. The beach will remain closed at least until Monday morning, when the results of a bacterial count will be available.

"As a policy, once there's sewage in the water we close it for 48 hours anyway," said Richard Kebabjian, spokesman for the county Department of Health Services. "Any time sewage enters the ocean, there's a potential for illness."

The beach will remain closed until tests show the bacterial counts have returned to acceptable levels, he said.



Control

96-h forecast from 00 UT 28 OCT

964 mb

Control + NSCAT

976 mb

"Truth" (ECMWF)

976 mb

Figure 9. (a) Control and (b) NSCAT-N 2° × 2.5° GEOS-1 sea level pressure forecasts. (c) ECMWF verifying analysis.

Atlas and Hoffman (2000)

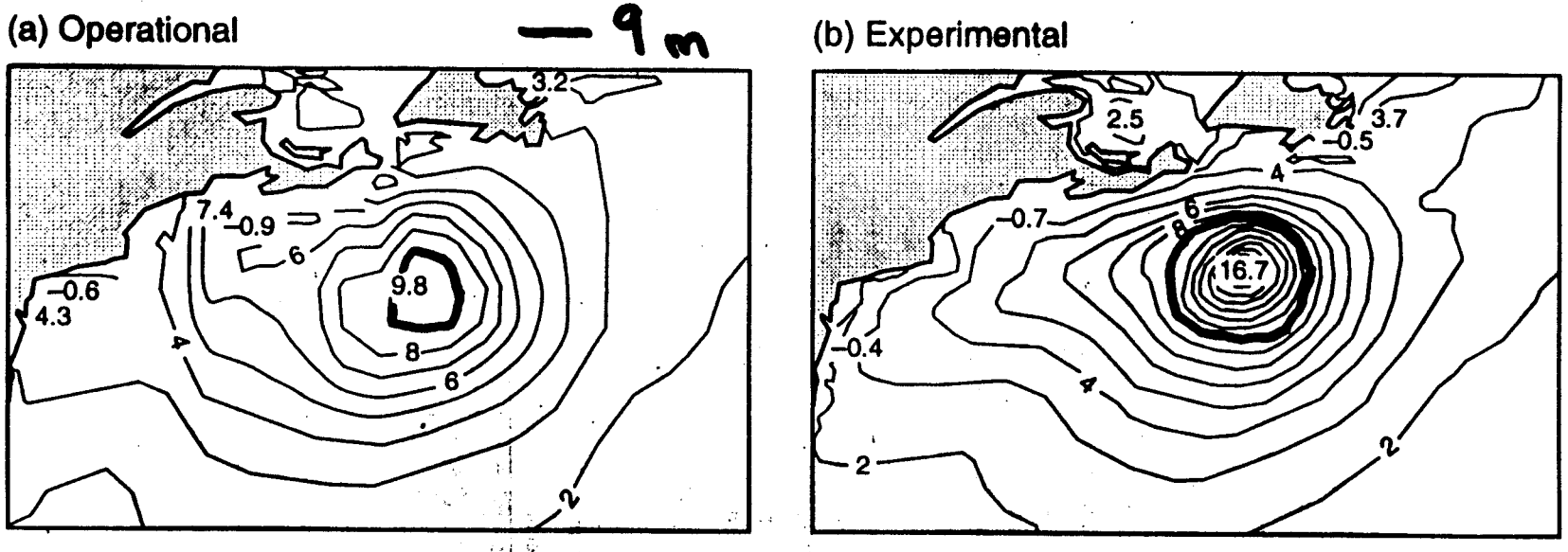
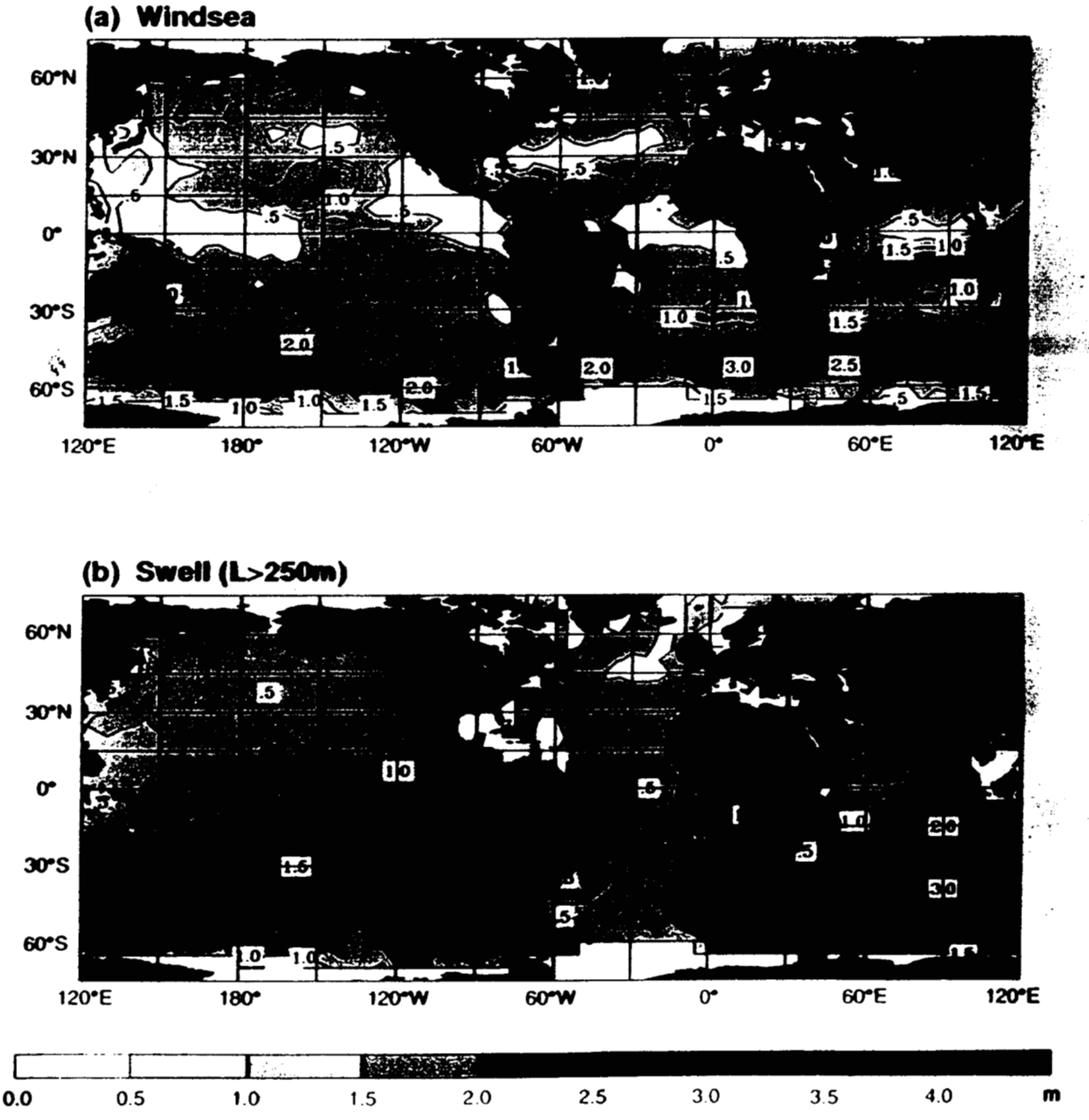


Figure 4. Thirty-six-hour wave height forecasts made with two different ECMWF forecast-analysis systems: (a) T213 operational system of 9 September 1995, named Operational, and (b) T639 system, named Experimental. Initial conditions were at 12 UT 9 September 1995.

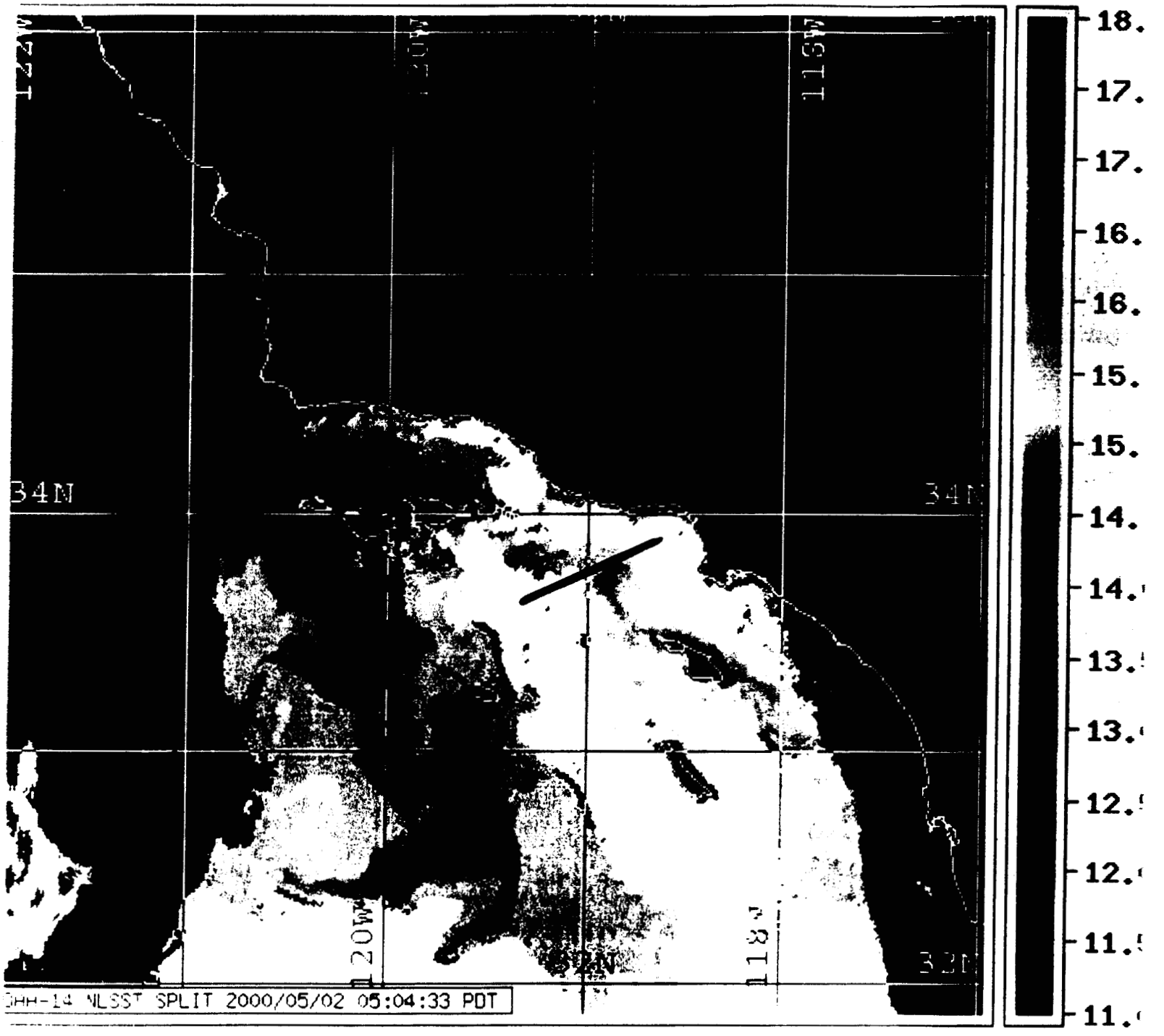
Janssen (2000)

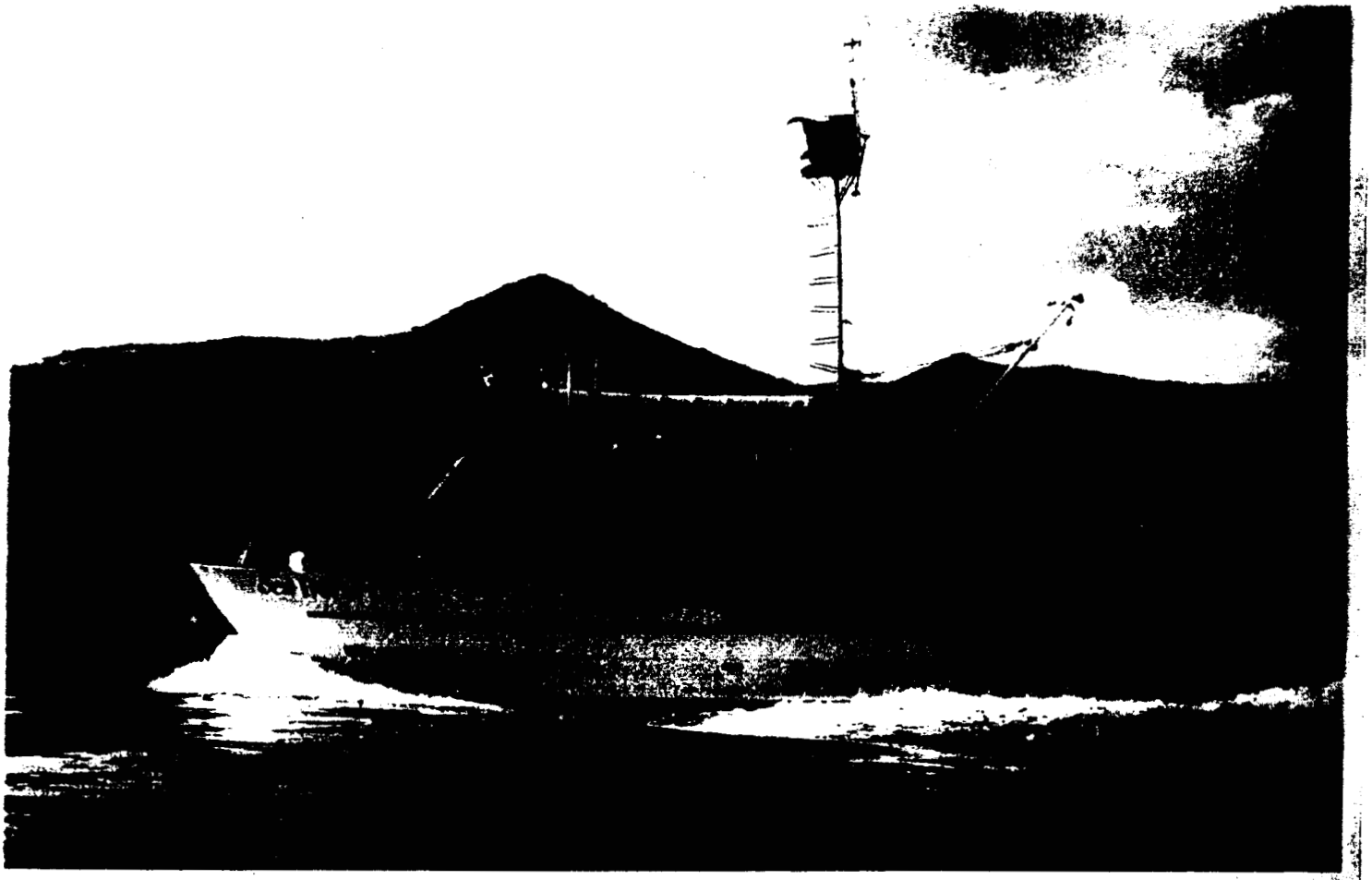
ERS-1 Jun-Aug 1994



Heimbach and Hasselmann (2000)

AVHRR SST 2 May 2000





Sea World UCLA


economy; not just to our food supply;
not just to America's trade and
security; but to the fabric of life itself.


GLOBAL CHANGE
CEOS
IGFA
The IGOS Partnership
An agreement among the partners for the definition, development and implementation of an Integrated Global Observing Strategy
GCOS GLOBAL CLIMATE OBSERVING SYSTEM
Global Ocean Observing System
GTOS
F A O
ICSU
IOC
UNEP
WMO